

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1, 3, 4, and 6-13 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

3. Applicant has amended claim 1 to state that the gas tight material is formed in part by the solid electrolyte and in the remaining part by a glass cover. This in conjunction with the previous limitation that the reference electrode be completely surrounded by the gastight material is presumably an attempt to specify that the gastight material comprises these two materials *solely* and cannot include additional gastight barriers or elements. However, it is unclear how applicant can claim this when even the present invention requires the presence of electrical leads 22 connected the reference electrode 10 (see fig. 1 and 2). Because the lead has to be in touch with the reference electrode to provide an electrical connection, wherever this lead is in contact with the reference electrode is a portion of the reference electrode that is not *completely surrounded* by a gastight material that is comprised *solely* of the electrolyte and low sodium glass.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1, 3, 4, 6, and 8-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gür et al (USP 5,827,415) in view of Sridharan et al (USP 6,124,224).

6. Gür disclose a gas sensor comprising a layer structure including a reference electrode (22 or any combination of elements 22-24) that are completely surrounding by a gastight material and a catalytically active working electrode 27 which is exposed to the measurement gas. The gas tight material is formed in part by a solid electrolyte layer 21 and in the remaining part by a glass cover 26. See fig. 2D and 2E and col. 5, l. 20 through col. 6, l. 4. Although Gür discloses other elements, such as oxygen barrier 23, as also providing a gas seal, even the present invention requires other elements that would have to contribute to the claimed gastight material (e.g. leads 22) and claim 1 cannot be construed as being limited to a gastight material consisting solely of electrolyte and sealing glass (see the 112 rejection above). Hence, the fact that Gür might have additional gastight materials is not deemed to read free of the teaching of Gür. Moreover, as discussed in the response to the arguments below, all of elements 22-24 together read on the term “reference electrode” giving the term its broadest reasonable interpretation. Hence, if elements 22-24 read on the defined “reference electrode”, then elements 21 and 26 of Gür are completely surrounded by a gastight material formed solely of the electrolyte and the glass sealing material.

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7. Gür does not explicitly disclose the use of a low sodium glass as the glass for the cover layer. Sridharan teaches the use of a glass for sealing various sensor components. This glass contains little or no sodium, provides a high resistivity at high temperatures, and has a thermal expansion coefficient comparable to that of the other sensor components like the electrolyte or other ceramic substrates. See col. 3, ll. 20-42. It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the glass composition of Sridharan for the glass sealing material of Gür in order to provide a glass having high resistivity and a thermal expansion coefficient comparable to the other sensor components.
4. With respect to the electrolyte composition, see Gür, col. 3, l. 65 through col. 4, l. 5.
5. With respect to the use of gastight materials that are electrically insulating, see the abstract of Sridharan. In addition, electrolyte is generally ion conductive, but is considered electrically insulating (i.e. it doesn't have appreciable electronic conductivity).
6. With respect to the use of a heating system, see Gür, fig. 4 and col. 7, ll. 1-18.
7. With respect to the reference electrode composition, Gür teaches that it comprises both metals and metal oxides. See col. 5, ll. 42-48.
8. With respect to the working electrode composition, it can comprise precious metals or oxides. See Gür, col. 5, l. 67 through col. 6, l. 4.
9. With respect to operating on the potentiometric measurement principle, Gür discloses using the sensor for Nernstian measurements. See col. 3, ll. 10-24. Nernst measurements are potentiometric measurements.
10. With respect to the specified λ values, because Gür discloses all the structural limitations of the claims, then it presumably also possesses the capability of measuring the various λ values.

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11. Claims 14, 16, 17, and 19-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gür in view of Sridharan and Omara et al (USP 6,153,071).

12. As discussed for claim 15 in the previous office action, Gür already disclosed a process for producing a sensor element having a combination of a carrier layer, a solid electrolyte, a reference electrode, and a gastight cover layer. See fig. 2 and 3 and the discussion above.

However, Gür did not assemble its sensor components in the manner recited by claim 14. Claim 14 appears to read on fig. 1 where the sealed reference electrode 10 is placed on the same surface as the working electrode. However, Omara teaches that one can either place the potentiometric electrodes for the sensor on opposite sides of the electrodes (compare fig. 4 of Omara with fig. 2 and 3 of Gür) or on the same side of the electrolyte (see fig. 5 of Omara). See also col. 5, ll. 31-56. In the embodiment of fig. 5 of Omara, the electrolyte layer 214 would be placed over the carrier layer 260 followed by the forming of the two electrodes (216, 218) followed by the forming of any covering layers (220, 221) over the electrode or electrodes. Because Omara teaches that one electrode of the potentiometric sensor can be placed either opposite or adjacent the other electrode without any change in essential operation, it would have been obvious to one of ordinary skill in the art at the time the invention was being made to substitute the reference electrode location of Gür for another to achieve the predictable result of providing a functioning sensor. In fact, because Gür teaches that the reference electrode is sealed away from any gas exposure (col. 6, ll. 55 and 56), there is no criticality on where it is located on the solid electrolyte and the alternate arrangement of Omara would have provided the same predictable result. Furthermore, Omara teaches that the arrangement of fig. 5 has an advantage over the arrangement of fig. 4 in that both electrodes are separated from the heating element. In fig. 4 of

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Gür, the reference electrode is closer to the heating element than the working electrode.

Utilizing the structure of fig. 5 from Omara would result in both of the electrode being the same distance away from the heater, thereby less subject to thermal gradients.

13. Gür also does not disclose the use of a low-sodium glass as the glass cover layer.

Sridharan teaches the use of a glass for sealing various sensor components. This glass contains little of no sodium, provides a high resistivity at high temperatures, and has a thermal expansion coefficient comparable to that of the other sensor components like the electrolyte or other ceramic substrates. See col. 3, ll. 20-42. It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the glass composition of Sridharan for the glass sealing material of Gür in order to provide a glass having high resistivity and a thermal expansion coefficient comparable to the other sensor components.

14. With respect to the various dependent claims, see the discussion of Gür and Sridharan above.

Response to Arguments

15. Applicant's arguments filed 1-17-2008 have been fully considered but they are not persuasive. Applicant urges that the glass seals (16, 26) of Gür are merely supplemental to the electrolyte and the oxygen barriers. It is unclear how this configuration of Gür reads free of the claimed subject matter. In particular, fig. 2D of Gür shows the glass seal 26 and electrolyte 21 completely surrounding the oxygen reference compound 22 that forms in part the reference electrode. This is analogous to the reference electrode configuration shown in fig. 1 of the present invention where the gas tight cover 16 and electrolyte 14 are shown to completely

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surround the reference electrode. Hence, the gas tight material of Gür is formed in part by the solid electrolyte and in a remaining part by the glass cover layer, which reads on the claimed configuration. It appears to be that applicant is urging that because Gür is also teaching the presence of an oxygen barrier (14, 23), it doesn't read on the now set forth gas tight material. This is unpersuasive for two reasons. First, the claims are constructed with open language (i.e. the invention is "comprising" the set forth features) and is not limited to the components set forth in the claims. Hence, the combination of glass seal 26 and electrolyte 21 in fig. 21 constitutes a gas tight material even if Gür teaches the addition of other gas tight materials as well. For example as the examiner noted above in the 112 rejection, the present invention also requires the presence of an electrical lead and that that lead must also be functioning as a gastight barrier. Second, what Gür refers to as the oxygen barrier can be construed as being part of the actual reference electrode. In particular, element 22 of Gür is the oxygen reference compound, oxygen barrier 23 is a Au or Pt layer over the reference compound 22 and layer 24 is a Pt foil that functions as a current collector. See col. 5, ll. 49-56. Hence, the combination of elements 22, 23, and 24 reads on the defined reference electrode of the claims as elements 23 and 24 are functioning as the metal portion of the electrode while element 22 is defining the reference potential measured by elements 23 and 24. Essentially oxygen barrier 23 is functioning both as an electrical connection between current collector 24 and reference compound 22 and as a means for sealing the reference compound against oxygen transmittance. The claims do not define "reference electrode" with any specificity that reads away from the interpreting all of elements 22-24 of Gür as being the reference electrode.

16. Applicant's arguments concerning Omara appear to be based on the perceived failings of the earlier teaching of Gür against the claims. Because these earlier arguments were unpersuasive, these further arguments are similarly unpersuasive.

Conclusion

17. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KAJ K. OLSEN whose telephone number is (571)272-1344. The examiner can normally be reached on M-F 8:00-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/Kaj K Olsen/
Primary Examiner, Art Unit 1795
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